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Maine Agricultural Experiment Station

ORONO

BULLETIN No. 155 **MARCH, 1908**

ORCHARD NOTES, 1907.

21

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AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

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BULLETIN No. 155

ORCHARD NOTES, 1907.

W. M. MUNSON.

In Bulletin 139 of this Station records of the Station work in Kennebec County orchards were brought down to date, and suggestions were made as to further investigations. The almost unprecedented winter of 1906-7, however, with its destructive effects upon the orchards, was followed by the removal of the writer, who has been in charge of the work from its inception, to a distant state. This combination of circumstances brings to an inevitable close a work which has been full of interest and which promised much for the future of Maine orcharding. Though many trees were killed outright, and others seriously and permanently injured, by the effects of the winter of 1906-7, there was a fair crop of fruit in most sections of the state, and never in the history of the Station work has the fruit been larger or fairer than it was in 1907. Records of the season were made, as in former years, and a general summary of the investigations is presented in the present bulletin.

Studies of physiological and practical problems in orchard pruning were inaugurated, and will be continued, though in another state. The general principles involved are the same, whether the details be worked out is Maine or in California; and the lessons taught, if of any value, should be as applicable in the management of Maine orchards as elsewhere.

CULTURE AND FERTILIZATION—A SUMMARY.*

At the end of ten years, a remarkable change is presented in the condition and appearance of the two lots of trees discussed under the above heading in several bulletins of this Station. Unfortunately the Gravensteins included in the study, like all trees of this variety, proved unreliable as to hardiness, and many of them have been lost. The Tolmans, however, have made a very satisfactory growth and at present form the basis of a vigorous, productive orchard, just in its prime.

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* For previous discussions of this subject see Bulletins of this Station as follows: 89, pp. 1-12; 122 pp. 182-190; and 139, pp. 51-52.

In 1898 a young Tolman and Gravenstein orchard of 80 trees, planted 8 to 10 years, was selected as the basis of operations. This orchard, located on the farm of Charles S. Pope, in Kennebec county, is situated on a high, rocky, sandy hillside, with an eastern exposure. While not an ideal situation, it represented fair average conditions, and the trees were just beside a large Baldwin orchard, which had been planted under similar circumstances. The land was used as a pasture, and had never been plowed. During the first 10 years, or until the Station work was begun, no special attention was paid the young trees, except to keep out borers and give an occasional mulching.

Subsequent treatment was, in brief, as follows: † In May, 1898, the whole area was given steamed bone at the rate of 500 pounds per acre. One half of the land, containing 40 trees, was then plowed and thoroughly harrowed; while the other half was mulched, partly with sawdust and partly with stable manure. On each plat thus made, 12 trees were left without an application of fertilizer. One-half of the remaining trees of each plat were given stable manure, and the other half a complete commercial fertilizer. In other words, on an area of approximately 2 acres, involving 80 trees, of 2 varieties,—Tolman and Gravenstein—the following distinct questions were under consideration: (1) a comparison of culture and mulching as a practicable treatment for young orchards. (2) Is an application of fertilizer necessary or desirable when trees are planted in virgin pasture lands. (3) The relative merits of stable manure and commercial fertilizers as sources of plant food for young orchards. Certain broader scientific problems, involving questions of plant physiology, must of necessity be omitted from this discussion because of incomplete data.

Exact figures are given in the accompanying tables, pages 128 and 129 compiled from field notes taken each year. These show the annual growth during a period of five years, since the trees commenced bearing, and the present condition of the several trees under observation. For previous records of condition and behavior, see Bulletin 89 of this Station, pages 5 and 6, and

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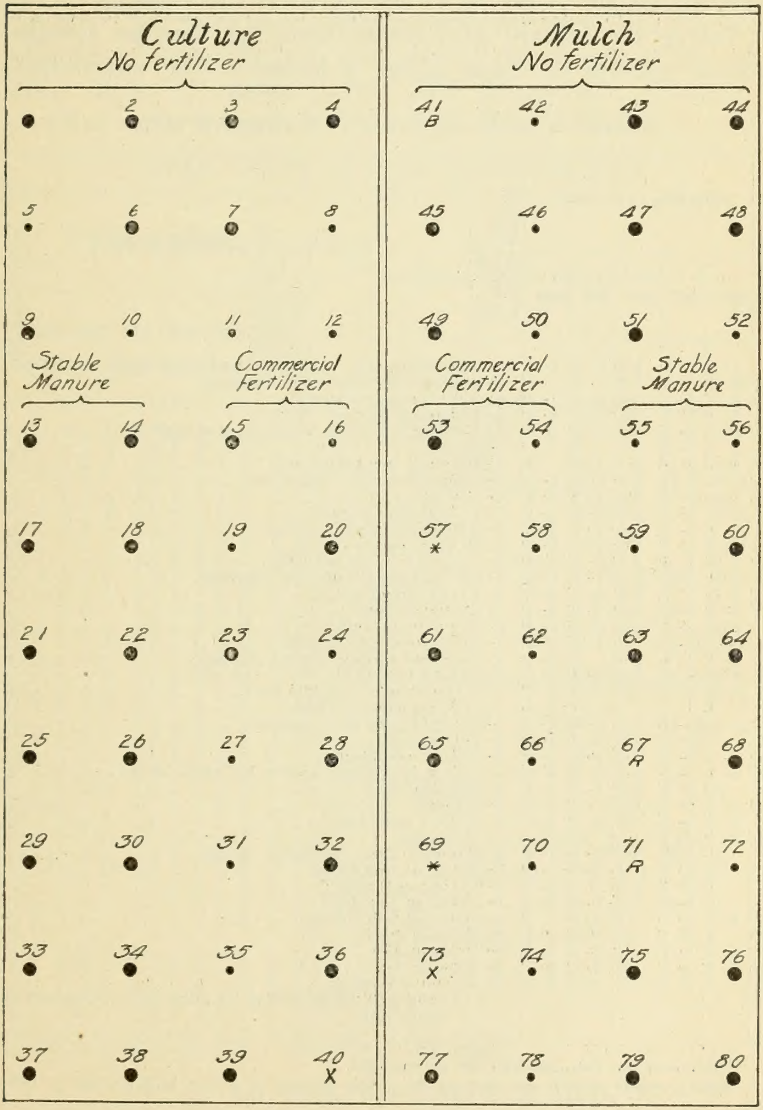
† For detailed statements as to treatment, with diagrams, see Bulletin 89 of this Station, pp. 2-4; and Bulletin 122, p. 184. Treatment in 1906 and 1907, same as in 1905.

Bulletin 122, pages 185 and 186. The diagram of the orchard, published in Bulletin 89, is reprinted herewith, to give a clearer idea of the arrangement and relative position of the several plats and individual trees.

DIAGRAM OF THE ORCHARD, (From Bulletin 89).



Explanation of Diagram: The significance of the figures in the above diagram is as follows; ● = trees bearing in 1902; •=trees not bearing in 1902; x=vacancy; *=Bellflower tree; R=Roxbury Russet; B=Ben Davis.

Numbers 1-12 and 41-52, inclusive, have received no fertilizer of any kind during the 10 years. The first mentioned trees were cultivated, however, while the others were mulched, as shown in the diagram. Numbers 13-24 and 53-64, respectively, are Tolman. The remainder are Gravenstein, except as noted, and numbers 42, 46, 50, 66, 70, 74 and 78, which are Tolman.

Taking the orchard as a whole, there has been an average annual growth of from 4½ to 7 inches. The unfertilized

Annual Growth of Trees in Cultivated Area.

Number of tree.	Growth in inches.*					Average growth in inches for five years.	Condition of trees spring of 1907.†
	1902.	1903.	1904.	1905.	1906.		
1	6–8	4–6	4–6	3–4	2–4	4–6	Standing still. Not recovered from injury of 1904-5.
2	6–8	3–5	1–2	0	0	2–3	Practically dead; few blossoms.
3	8–10	5–7	2–3	2–4	1–3	4–6	Weak; few blossoms.
4	6–8	5–7	3–5	3–6	2–4	4–6	Checked by cold, 1906–7.
5	8–10	6–8	4–6	6–8	4–6	6–8	Partly recovered from injury of 1904-5.
6	4–6	1–2	0	0	....	1–2	Dead.
7	8–10	3–4	3–4	1–3	0	3–4	Dying; few blossoms.
8	10–14	10–12	5–6	8–10	5–7	8–10	Good condition; vigorous.
9	8–10	4–6	3–6	3–6	2–4	4–6	Weak.
10	10–12	6–8	6–8	8–10	4–6	7–9	Good strong tree.
11	6–8	4–6	2–4	2–4	3–5	3–5	Defective stock; failing.
12	10–12	7–9	5–7	5–7	6–8	7–9	Good type of tree.
13	8–10	4–6	4–6	3–4	4–6	5–6	Injured by mice 1906-7.
14	8–10	8–10	5–6	7–9	8–10	7–9	Fine tree; productive; vigorous.
15	8–10	5–7	1–2	6–8	3–5	5–6	Good condition.
16	4–5	8–10	7–9	7–9	3–5	6–8	Good condition.
17	8–10	6–8	4–6	6–8	4–6	6–8	Good condition.
18	6–8	10–12	7	9–10	4–6	7–9	Vigorous; productive.
19	6–8	4–6	2–3	0	2–4	3–4	Injured at base; defective stock.
20	8–10	10–12	3–4	5–8	4–6	6–8	Good condition.
21	10–12	6–8	6–7	8–12	5–7	7–9	Fine type of tree and fruit.
22	0	.....	.....	.....	6	......	Young tree set 1906.
23	10–12	10–12	4–6	8–10	6–8	8–10	Very strong and vigorous.
24	6	10–12	2–3	4–6	5–7	5–7	Good tree.
25	6–7	4–6	6–8	8–10	4–6	6–7	Good condition.
26	6–8	5–7	4–5	6–8	4–6	5–7	Fair condition; injured by mice, 1906-7.
27	12	7–9	4–5	1–3	1–3	5–6	Nearly dead.
28	4–6	6–8	2–4	1–3	3–5	3–5	Weak.
29	6–8	4–6	3–6	4–6	5–7	4–6	Good condition.
30	6–8	3–5	.....	0	.....	......	Vacant.
31	10	8–10	3–6	4–6	4–6	6–8	Nearly dead; defective trunk.
32	12	6–8	4–6	5–7	8–10	7–9	Part of tree dying.
33	8	3–5	5–7	1–3	4–6	4–6	Good condition.
34	10	8–10	3–6	1–3	6–8	6–7	Half of tree dead.
35	6–8	5–7	3	6–8	0	4–5	Dying; full bloom.
36	8	5–7	4–6	8–10	4–6	6–7	Doing well.
37	6–8	6–8	6	6–8	6–8	6–8	Doing well.
38	7–8	4–6	4–6	3–5	5–7	5–6	Doing well.
39	8	6–8	5–7	6–8	6–8	6–8	Good condition.
40	.....	.....	.....	.....	.....	......	Young tree, 1906; girdled by mice 1906-7; cions set in stub, 1907.

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*Fractions less than one-half are disregarded.

†For previous records see Bulletin 89 of this station, p. 5, and Bulletin 122, p. 185, 186.

trees, in general, have made less growth than the fertilized trees, and the uncultivated than the cultivated. As noted in the last report of this work, however:* "There is less tendency to deterioration, *i. e.* there are fewer dead or dying trees, among the Gravensteins on the mulched area than on the cultivated, possibly due to the fact that growth had been less vigorous, and the wood had more nearly matured previous to the recent severe winters. Little difference was noted in this respect in the relative effects of stable manure and commercial fertilizers." Another season's observations, following one of the most severe

Annual Growth of Trees in Mulched Area.

Number of tree.	GROWTH IN INCHES.*					Average growth in inches for five years.	Condition of trees, Spring of 1907.
	1902.	1903.	1904.	1905.	1906.		
41	8–10	8–10	4–6	8–10	4 ft	......	*Ben Davis.* Top-worked to Rome Beauty, 1906. Injured by cold 1906-7.
42	4– 6	5– 7	5–7	2– 4	4– 6	4– 6	Injured by cold, 1906-7.
43	4– 6	3– 5	3–5	2– 4	2– 3	3– 5	Injured by cold 1906-7.
44	6– 8	6– 8	4–6	5– 7	4– 6	5– 7	Injured by cold, 1906-7.
45	8–10	5– 7	3–5	1– 3	3– 5	4– 6	Top dying; injured by cold, 1906-7.
46	2– 4	4– 6	3–5	2– 4	3– 6	3– 5	Good condition.
47	4– 6	4– 6	3–5	2– 4	4– 6	4– 6	Fairly good tree.
48	3– 6	3– 5	4–5	1– 3	3– 5	3– 5	Moderately vigorous.
49	8–10	5– 7	5–6	4– 6	3– 6	5– 7	Good condition.
50	2– 3	1– 3	2–3	1– 3	2– 4	2– 3	Injured by borers.
51	6– 8	5– 7	4–7	2– 3	3– 5	4– 6	Good condition.
52	2– 3	1– 3	3–5	1– 3	3– 5	2– 4	Half of top weak.
53	6– 8	6– 8	1–3	4– 6	4– 6	4– 6	Good condition.
54	3– 5	4– 6	2–3	1– 3	5– 7	3– 5	Doing well.
55	4– 6	6– 8	3–4	4– 6	4– 6	4– 6	Good tree.
56	8–10	8-10	4–6	6– 8	4– 6	6– 8	Good tree.
57	10–12	7– 9	3–5	6– 8	10–12	7– 9	Bellflower. Fine tree; productive; good fruit.
58	5– 6	7– 9	5–7	3– 5	6– 8	5– 7	Doing well.
59	4– 6	8–10	6–8	3– 5	5– 7	5– 7	Good condition.
60	5– 6	5– 7	3–5	4– 6	3– 5	4– 6	Good condition.
61	6– 8	7– 9	4–6	3– 5	4– 6	5– 7	Moderately vigorous.
62	4– 6	6– 8	3–5	4– 6	3– 5	4– 6	Doing well.
63	8–10	8–10	4–6	4– 6	3– 5	5– 7	Noticeably good tree.
64	10–12	10–12	5–7	4– 6	4– 6	7– 9	Noticeably good tree.
65	10–12	3– 5	3–5	3– 6	4– 6	4– 7	Top dying.
66	2– 4	4– 6	1–3	1– 3	2– 3	2– 4	Weak.
67	10–12	8–10	4–6	6– 8	6– 8	7– 9	*Roxbury Russet.* Top-worked to *Rolfe*, 1906.
68	8–10	8–10	6–8	5– 7	3– 5	6– 8	Injured by cold, 1906-7.
69	12–14	8–10	4–6	6– 8	6– 8	7– 9	*Bellflower.* Very vigorous.
70	8	7– 9	3–5	8–10	3– 5	6– 7	Good condition.
71	5– 7	5– 7	1–2	5– 7	4– 6	4– 6	*Roxbury Russet.*
72	6– 8	6– 8	5–7	6– 8	6– 8	6– 8	Hurt by winter, 1906-7
73	.....	.....	.....	.....	.....	......	Young tree, 1906; vigorous.
74	1– 3	5– 7	1–2	1– 3	2– 3	2– 4	Good condition.
75	6	6– 8	5–7	8–10	4– 6	6– 7	Good tree.
76	6– 8	6– 8	6–8	6– 8	5– 7	6– 8	Doing well.
77	10–12	6– 8	2–3	4– 6	1– 3	5– 6	Nearly dead.
78	4– 6	5– 7	3–5	6– 8	3– 5	4– 6	Good condition.
79	8–10	7– 9	5–7	8–10	4– 6	6– 8	Injured by cold, 1906-7.
80	8–10	7– 9	6–8	8–10	5– 7	7– 9	Injured by cold, 1906-7.

*Fractions less than one-half are disregarded.

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* Bulletin 139 of this Station, p. 51.

winters in the history of Maine orcharding, confirms this statement, which is further emphasized by reference to the column of "Remarks" in the table. At the present time most of the Gravenstein trees on the cultivated area, and several of the mulched trees, are dead or dying. The Tolmans are nearly all in prime condition and bore an extra heavy crop of fruit in 1907.

The unfertilized trees show clearly that, on this soil, at least, additional plant food is an absolute necessity. While the rotting turf sets free a considerable amount of plant food when culture or mulch is first given, this material is soon exhausted and the trees assume the yellow, stunted appearance which is only too familiar. On the cultivated plat nearly all of the unfertilized trees were killed or seriously injured by the cold of the last winter. The mulched trees, while severely injured, suffered to a less marked extent than did the others. While at first glance this may seem an argument against the cultivation of trees, it would have no weight in the management of hardy varieties, and, as shown in previous reports, the cultivated trees live faster and produce more, during their life time than do the others.

Relative Yield of Fruit.

In 1902, the first bearing year of this young orchard, the following results, irrespective of fertilizers, were obtained: *

"Gravenstein—cultivated, 19 bearing trees, averaging .72 bbl. per tree; mulched, 14 bearing trees, averaging .59 bbl. per tree.

"Tolman—cultivated, 9 bearing trees, averaging .44 bbl. per tree; mulched, 6 bearing trees, averaging .50 bbl. per tree."

In the case of Gravenstein there was a decided difference, both in number of bearing trees and in average yield per tree, in favor of cultivation. With Tolman the number of bearing trees was greater by one-half on the cultivated area, but the average yield was slightly less.

Essentially the same results were obtained during the next two years. In 1904, the cultivated plat yielded,† "an average of 1.7 bushels per tree; while the mulched area, for the same number of trees, gave an average of 2 bushels per tree."

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* Bulletin 122 of this Station, p. 188.

† *Ibid,* p. 189.

In 1905, the cultivated Tolman trees gave an average of 4 bushels per tree, while the mulched trees yielded but 2.8 bushels

In 1906, when the season was excessively dry during the late summer and fall, the difference between culture and mulch was * "about as 1 to 2½ with the Tolmans, but was quite the opposite with the Gravensteins, the ratio being 3.4 to 1. In other words, while the average yield of 11 Tolman trees on the cultivated section was *one bushel* per tree, the average of the corresponding number of trees on the mulched section was *one barrel* per tree. Of 14 Gravenstein trees on the cultivated area, on the other hand, the average yield was 4.8 (one-half bushel) baskets, as compared with 1.4 baskets on the mulched area. As a matter of fact, the difference is even more striking than this, for of the 14 cultivated trees, 10 bore fruit, the minimum crop being 2 baskets and the maximum 13; while of the mulched trees but 2 bore fruit, one giving 1½ baskets the other 10 baskets." There is little doubt that the relatively late harvesting of the Tolmans, in connection with the dry fall, had much to do with the recorded yield.

In 1907, the largest crop in the history of the orchard was produced. As in the previous year, the mulched Tolmans gave better returns than did the cultivated trees; and the general health and vigor of the trees seemed about the same in each case. Unfortunately, in the absence of the writer, some thinning of the overloaded trees was done in this orchard, and this may vitiate the yield record for this year.

In general, the behavior of the several Tolman trees since coming into bearing is indicated by the table. The Gravensteins are omitted because of the great irregularity caused by destructive weather conditions.

From the table it will be seen that there is a marked individuality in the bearing habit of the several trees, *e. g.*, numbers 14 and 21, cultivated, and 53, 56, 58 and 61, mulched, may be characterized as heavy bearers. Numbers 16 and 24, cultivated, and 54, mulched, are noticeably light yielders. Numbers 13, 15, and 19, cultivated, and 55, 56, 58, 59, 60 and 63, mulched, bear regularly; while 16, 18, 20 and 23, cultivated, and 53, 60 and 64, mulched, are alternate in bearing habit.

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* Bulletin 139 of this Station, p. 52.

As noted in the last report,* there is an apparent advantage from the use of stable manure, rather than that of "chemicals." This advantage, however, is not sufficient to warrant the extra expense incident to hauling the manure for long distances over rough roads. The supply of humus, wherein lies the chief advantage of the manure, may be more cheaply applied in the form of straw or meadow hay; or, on cultivated lands, in the form of green manures and cover crops. The same amount of plant food as is contained in a given amount of manure may, in many cases, be obtained and applied more economically in the form of concentrated fertilizers. Where stable manure is readily obtainable, however, and need not be hauled long dis-

Cultivation vs. Mulch—Annual Yields.

Number of trees.	CULTIVATED.						
	1902.	1903.*	1904.	1905.	1906.	1907†	Remarks.
			Bush.	Bush.	Bush.	Bush.	
13	Good...........	......	3.0	2.0	1.3	0.0	Injured by mice, 1906-7.
14	Good...........	......	2.8	6.5	2.0	8.8	
15	Small..........	......	1.0	2.4	2.0	2.0	
16	....	......	0.5	1.9	.3	2.0	
17	Medium.........	......	1.8	4.0	1.0	5.1	
18	Medium.........	......	2.0	7.0	.3	7.0	
19	Small..........	......	1.2	2.5	2.3	3.0	
20	Small..........	......	.5	4.8	0.0	3.4	
21	Full...........	......	4.0	5.0	2.5	7.0	Extra; both tree and fruit.
22	Full...........	......	......	......	......	......	Dead. Replaced in 1906.
23	Small..........	......	1.3	7.6	0.0	7.8	
24	Small..........	......	.3	.0	.3	5.5	
	Total........	......	18.4	43.7	12.0	51.6	
	MULCHED.						
53	Small..........	......	.8	4.5	3.3	8.2	
54	....	......	.0	0.0	0.0	2.5	
55	....	......	1.2	2.5	1.8	5.5	
56	....	......	3.0	4.2	2.8	9.5	
57	Small..........	......	Full..	Medium	......	......	Bellflower.
58	....	......	5.0	2.5	7.5	8.8	
59	....	......	1.8	1.7	2.4	5.5	
60	Medium.........	......	1.8	3.0	.3	7.0	
61	Medium.........	......	2.6	2.2	6.8	9.0	
62	....	......	1.0	3.2	1.8	8.5	
63	Small..........	......	3.5	3.2	3.6	7.8	
64	Small..........	......	1.3	4.0	.8	10.	
	Total........	......	22.0	31.0	31.1	82.3	

*By an accident the records of 1903 were rendered useless and are omitted. There was a fair crop on most of the trees.

†The accuracy of the figures for 1907 is a little doubtful because of thinning. See text.

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* Bulletin 139 of this Station, p. 52.

tances, or over rough roads, there is nothing better for use in the average Maine orchard.

THE POTASH ORCHARD.

Observations concerning the effects of different salts of potash upon the growth and behavior of apple trees have been continued.* Several of the trees injured by the winter of 1904-5 are forming new tops, and in some instances the "water sprouts" which were developed as a result of this injury, and subsequent severe pruning, bore fruit in 1907. The fact that a new head may profitably be formed on trees which are partially winter-killed is thus practically demonstrated.

In 1906-7, some of the trees in this orchard were again severely injured by the cold winter. Such trees as escaped, however, bore a full crop of extra fine fruit. The treatment of the orchard this year was similar to that in preceding years, and the effect of high culture and abundant plant food was very apparent in the size and character of the fruit. In 1907, 100 pounds of nitrate of soda and 200 pounds of acid phosphate were applied broadcast over the whole orchard. Fifty pounds of each of the potash salts, muriate, sulphate, and kainit, were applied to the several plats; instead of 70 pounds as in former years.

No report upon the physiological and chemical studies projected in connection with this work can be made. In behavior of tree, and in gross character of fruit, however, no specific effect of any particular potash salt can be observed. It may be that on some soils, and in certain conbinations, the particular form of potash used is of importance; but in no case, so far as the work of the Station has gone, does the significance of this factor appear.

ORCHARD RENOVATION.

The work of "orchard renovation" was carried on as in previous years,† during the past season, and, as demonstrating possibilities in this direction, may be regarded as completed. The same may be said as to the fertilizer requirements of this particular orchard. As a field for studies in variation, however, the work is but just begun. Some interesting individual variations have been under observation for some time, and will be used in further investigations.

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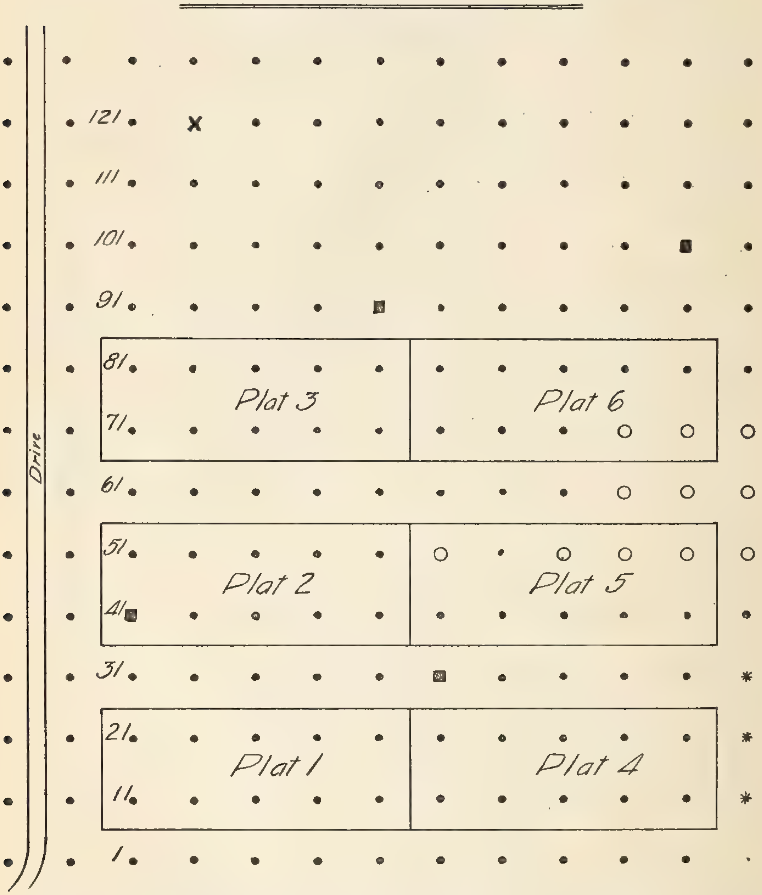
* For previous references to this work see Bulletin 89 of this Station, pp. 12-18; and Bulletin 122, p. 190.

† See Bulletin 89 of this Station, p. 18; Bulletin 122, p. 190; Bulletin 139, p. 53.

ORCHARD RENOVATION.—DIAGRAM OF THE ORCHARD.*



The accompanying table of annual yields (pages 137 and 138), gives the actual performance of the individual trees, during the past five years. The actual yield, in barrels, from 78 trees, not counting Gravensteins, vacancies, or the 10 trees in the outside row, for the several years is as follows:

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* From Bulletin 89, of this Station, p. 20.

In spite of the injury wrought to many of the trees by the severity of the past winter, a full crop of very fine fruit was produced. A record of the yield is given in the accompanying table of annual yields.

The results of another season's observations but confirm the conclusions drawn last year,† viz.: "The effect of treatment given this orchard is visible as far as the orchard can be seen, and from a hillside one-half mile distant the different plats can readily be distinguished by reason of differences in color and vigor of foliage. On those plats from which nitrogen has been withheld, there is now a decided lack of color and a weak growth indicative of neglect; while on the plats receiving nitrogen, whether alone or in combination, a vigorous growth and deep green foliage are evident. On this particular hillside, nitrogen is the one thing lacking; potash and phosphoric acid, either alone or in combination, giving no better results than are found with the check trees. The plat receiving all three elements, however, is decidedly the best in the lot, although if there is any difference in the soil, this is the poorest corner of the orchard."

The work in this orchard has clearly shown that it is wholly practicable to take an old, unprofitable, rapidly degenerating apple orchard and, in spite of three unusually severe winters, at close intervals, (1) to bring that orchard into a profitable bearing condition; (2) to force Baldwin trees, by proper feeding, to produce fruit every year, instead of on alternate years; (3) to produce profitable crops of fruit by the aid of "chemicals" only, in connection with intelligent culture, pruning and spraying. It has further been shown, (4) that upon the particular soil involved, all expenditures for fertilizers, unless these fertilizers contain some nitrogen, is an absolute waste of money; (5) that, apparently, the excessive use of nitrogen, in the absence of potash or phosphoric acid, or both, is distinctly injurious to the fruit; and (6) as a corollary to the other points, that the best results are obtained from a complete, well balanced fertilizer, rather than from an excessive use of any one element.

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† Bulletin 139 of this Station, p. 53.

Annual Yield, in Barrels, Renovation Orchard.

Year	1903	1904	1905	1906	1907
Total yield	162	228	112	49	120
Average per tree	2.1	2.9	1.4	.6	1.5

These figures, in the face of two unusually severe winters, which wrought much damage to these trees, as well as to others all over the State, require no comment in connection with the question of the practicability of rejuvenating the orchards of Maine. The yield is not large, not as large as it should be, but it must be remembered that only 10 trees out of the lot received the treatment which has been recommended, and demonstrated, as best; while 26 of the trees were in the check rows between the plats.

As between the 10 trees receiving complete fertilizer (Plat I) and the adjoining check trees, which were in every way comparable, the following figures, showing the average yield per tree each year, are significant. Naturally, however, the check trees, being so close to the others, received some benefit from the fertilizer applied, and do not fairly represent the conditions in an untreated orchard.

Average Annual Yield of Fertilized and Unfertilized Trees.

Year	1903	1904	1905	1906	1907
Fertilized trees	bbls. 3.9	bbls. 2.6	bbls. 2.6	bbls. .9	bbls. 2.4
Unfertilized (check) trees	2.6	3.6	1.1	1.0	1.3

Orchard Renovation—Annual Yield.

Plat and number of tree.	Yield per Tree, in Barrels.					Remarks.
	1903.	1904.	1905.	1906.	1907.	
Plat I. Tree No.						
11	4.5	1.0	2.8	0.0	2.0	
12	3.5	0.0	2.6	0.0	2.2*	*Extra good fruit, 1907.
13	3.5	3.3	2.4	0.0	3.3	
14	2.0	3.0	3.4	.2	3.0	
15	6.5	1.7	3.0	0.0	3.3	
21	3.0	2.8	1.9	1.4	1.8	
22	3.0	6.0	1.0	3.8	1.1	
23	4.0	1.6	3.2*	0.0	2.6*	*Extra good fruit, 1905, and 1907; not well colored in 1907.
24	.5	3.0	.6	2.4	0.0	
25	8.5	4.0*	4.8*	0.8*	4.2	*Extra good fruit. Tree injured by cold, 1906–7.
Check Row Tree No.						
31	3.5	6.1	.1	2.8	.9	Tree injured by cold, 1906–7.
32	5.0	3.9	2.1	2.2	1.8	Fruit small in size
33	1.5	2.0*	2.1	0.0	2.5	*Extra good type.
34	1.5	4.2	0.0	0.0	.3	Injured, 1904-5. New top forming.
35	1.5	1.7*	1.5	0.0	1.1*	*Extra good type.
Plat II. Tree No.						
41	.....	......	......	......	.....	Vacant.
42	3.0	8.7	0.0	0.0	1.4	Nearly killed, winter of 1904-5, Recovering.
43	0.0	2.5	0.0	1.0	1.3	
44	3.5	4.1	0.0	0.8	1.0	Badly injured by cold, 1906-7.
45	1.0	5.4	1.2	0.0	1.8	Badly injured by cold, 1906-7.
51	4.5	5.9*	2.4*	1.4*	2.1	*Extra good type of fruit. Injured, 1906-7.
52	1.0	3.4	0.0	0.0	.3	Injured by cold, 1906-7.
53	5.0	2.7*	3.3	0.0	2.1	*Extra good type. Injured by cold, 1906-7.
54	.5	4.7	0.0	0.0	.8	Injured by cold, 1904-5. Recovering.
55	.5	3.7	.1	0.6	1.4	Injured by cold, 1904-5. Recovering.
Check Row Tree No.						
61	.....	1.5	0.0	1.0	0.0	Nearly killed by winter, 1906-7.
62	2.5	3.8	0.0	5.0*	0.0	*Extra good type.
63	1.0	4.5	.1	4.4	0.0	
64	1.0	6.4	0.0	0.0	2.0	
65	2.0	4.0	0.0	0.0	1.4	Injured by cold, 1904-5. Recovering.
Plat III. Tree No.						
71	5.5	.4	2.1	0.0	2.5	
72	6.5	.0	3.4	0.0	.5	
73	1.5	.4	1.7	0.0	1.4	
74	1.0	1.0	.5	1.0	.9	
75	0.0	.8 †	1.0	0.0	3.2	
81	6.0	2.9	1.5	1.9	1.7	†Nearly all the fruit on this plat dropped early in 1904, remainder was soft and worthless as in April or May. Numbers 71, 72, 73, 81, 82, and 84, all injured by winter of 1906-7.
82	2.5	1.0	3.2	0.0	2.6	
83	3.5	1.5	2.6	0.3	3.6	
84	4.0	.9	4.8	0.0	2.4	
85	4.0	1.1	4.1	0.0	1.4	
Check Row Tree No.						
91	.....	3.5	.6	0.0	1.2	
92	.....	1.8	.5	0.0	.....	Dead.
93	.....	3.0	2.3	0.0	1.6	
94	.....	5.4	3.6	0.0	1.5	
95	.....	......	.....	......	.....	Vacant.

Orchard Renovation—Annual Yield—Concluded.

Plat and number of tree.	Yield per Tree, in Barrels.					Remarks.
	1903.	1904.	1905.	1906.	1907.	
Plat IV. Tree No.						
16	1.5	1.3	1.0	0.0	3.0	Tree injured by cold, 1906-7.
17	2.0	6.5*	.5	3.8*	.7	*Extra good type. Badly injured, 1906-7
18	.0	.4	.9	0.0	.5	
19	0.0	2.5	.7	0.2	1.0	
20	7.0	5.8*	1.3	3.0*	2.8	*Extra good type.
26	.0	2.5	.1	0.0	.7	
27	1.5	5.0	1.9	0.8	2.2	
28	.0	3.7	.4	0.0	1.3	
29	.0	5.1	2.3	0.0	3.3	
30	4.0	2.4	3.4	0.0	2.9	
Check Row Tree No.						
36	.....	......	.....	.....	.....	Vacant.
37	.0	5.0	.2	1.6	.6	
38	.0	2.4	1.0	0.0	.8	
39	.0	5.8	.3	1.8	1.5	
40	.0	.4	.1	0.0	.....	Almost dead, 1906. Dead 1907.
Plat. V. Tree No.						
46	2.0	4.2	.0	0.0	1.0	Injured by winter 1904-5. Recovering.
47	5.0	5.8	3.4	2.2*	1.0	*Extra good type. Nearly killed by winter, 1906-7.
48	.0	2.2	1.6	0.0	1.3	
49	.0	2.5	1.2	0.0	.3	
50	.0	1.8	1.0	0.0	1.0	
56	.....	......	.....	.....	.....	Gravenstein.
57	.0	.0	.9	0.0	.4	Tree broken; only one limb; extra fine fruit.
58	.....	......	.....	.....	.....	Gravenstein.
59	.....	......	.....	.....	.....	Gravenstein.
60	.....	......	.....	.....	.....	Gravenstein.
Check Row Tree No.						
66	1.5	2.4	1.6	0.0	1.2	Injured by winter 1906-7.
67	2.0	2.3	.8	1.4	1.1	Injured by winter 1906-7.
68	2.5	1.3	.2	0.0	1.3	
69	.....	......	.....	.....	.....	Gravenstein.
70	.....	......	.....	.....	.....	Gravenstein.
Plat VI Tree No.						
76	3.0	1.0	1.0	.2	2.5	Fruit very large, 1907; not well colored.
77	6.5	0.0	1.3	0.0	.7	Forming new top.
78	.0	.0	.1	0.0	.5	
79	.....	......	.....	.....	.....	Gravenstein.
80	.....	......	.....	.....	.....	Gravenstein.
86	3.0	.7	1.6*	0.0	1.2	*Also .8 bbl. Starkey on portion of tree.
87	4.0	.0	2.8	0.0	2.9	Fruit large; not well colored.
88	3.5	2.8 †	3.5	1.6	3.5	†Condition of this fruit similar to that of plat 3, in 1904.
89	.0	1.1	.5	0.0	.6	
90	1.0	3.2	.9	1.1	.7	
Check Row Tree No.						
96	.....	7.0	.0	0.0	.9	
97	.....	2.6	1.0	0.2	1.8	
98	.....	3.4*	2.0	0.0	2.7	*Extra good fruit. Injured by cold, 1906-7.
99	.....	.5	1.0	0.0	1.2	
100	.....	4.2	1.1	0.0	.5	

THE TOP-WORKED ORCHARD.*

The work in top-grafting was suddenly terminated by the cold winter of 1906-7; practically every tree in the orchard being killed or badly injured. Not only the top-worked trees, but the Ben Davis trees left for comparison, suffered. The work is therefore abandoned without the possibility of drawing conclusions. The following record was made in October, 1907.

Condition of Top Grafted Orchard, October, 1907.

Baldwin—1 tree killed by winter, 1906-7; 1 tree, previously weak, dead; 4 trees badly injured.

Ben Davis—4 original trees, left as checks, more or less injured; several original trees, not directly included in this experiment, but intended for further trials, killed.

Sutton—4 trees killed by winter, 1906-7; 1 tree injured by winter; 1 tree apparently in good condition.

Jonathan—1 tree killed by winter, 1906-7; 4 trees badly injured by winter; 1 tree apparently in good condition.

THE FISHER FORMULA.†

For 4 years a comparison has been made between the highly nitrogenous fertilizer, made after the commonly known "Fisher formula," and a fertilizer containing less nitrogen and more phosphoric acid and potash. The "Fisher formula" ‡ calls for about 8.6 per cent nitrogen, 3.3 per cent phosphoric acid, and 11.9 per cent potash. The formula commonly known as the "Station formula," calls for about 3 per cent of nitrogen and 6 per cent phosphoric acid, and 8 per cent potash. The "Fisher" fertilizer costs about $42 to $43 per ton; the other about $32.

The total number of trees included in this comparison is 48, of which 40 are Baldwins, under cultivation, and the balance are Tolmans in "sod mulch." The Baldwins were about 30 years old and in an exhausted condition when the work was commenced; the Tolmans were about 20 years old and in good vigorous condition, though not large.

Both lots of trees responded freely to the treatment, and have borne every year since. The annual yields are given in detail in the accompanying table. The stirring of the soil, and subsequent decay of the turf, in case of the cultivated trees, Baldwins, obscure specific differences in the relative merits of the two fertilizers used, during the first few years. To arrive at a true estimate, the work should be continued several years longer. Four years of treatment, however, with the record of 3 successive crops, are not without suggestive value.

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* Bulletin 122 of this Station, p. 198; and Bulletin 139, p. 56.

† Bulletin 122 of this Station, p. 196.

‡ loc. cit.

Annual Yields, "Fisher" vs. "Station" Fertilizers,—Baldwin.

Treatment, and number of tree.	Yield per tree, in bushels.			Remarks.
	1905.	1906.	1907.	
Fisher Formula, No. 1	0.0	7.0	2.8	
2	4.0	0.0	2.3	Small tree, partly broken.
3	12.8	.8	12.3	
4	8.8	.5	6.8	
5	2.5	19.0	0.0	Nearly killed by winter, 1906-7.
6	12.3	0.0	10.8	
7	5.0	10.0	1.8	
8	10.8	1.6	14.0	
9	9.0	0.0	6.0	
10	14.0	0.0	8.0	
11	15.5	0.0	12.5	
12	12.5	6.5	9.3	
13	16.0	1.5	14.0	
14	6.8	2.0	6.5	
15	12.5	0.0	10.5	
16	21.0	2.5	13.8	
Average	10.2	3.2	8.2	*Average per tree for 3 years, 7.2 bushels.*
Check. (no fertilizer)				
17	3.3	6.0	0.0	Nearly killed by winter, 1906-7.
18	11.3	0.0	7.0	Injured by winter, 1907-6.
19	1.0	15.5	0.0	Injured by winter, 1906-7.
20	19.5	0.0	13.8	
21	0.0	17.5	0.0	Injured by winter, 1906-7.
22	0.0	5.8	0.0	Nearly killed, winter, 1906-7.
23	1.0	13.5	0.0	Injured by winter, 1906-7.
24	....	....	....	Vacant.
Average.	5.1	8.3	3.0	*Average per tree for 3 years, 5.5 bushels.*
Station Formula 25	15.5	0.0	7.0	
26	5.0	5.0	1.5	Making strong growth of new shoots.
27	0.0	2.3	2.0	Half of tree Dyer. Injured 1904-5; recovering
28	0.0	0.0	1.3	Part of tree dead; balance vigorous.
29	13.5	15.5	7.0	Strong growth of new shoots.
30	3.0	3.0	0.6	
31	1.0	14.0	0.0	Strong growth of new shoots.
32	2.0	.8	2.8	Injured by winter, 1906-7.
33	2.3	0.0	0.0	Small remnant of a tree.
34	7.3	0.0	3.9	
35	6.5	6.5	4.8	
36	15.5	7.0	4.3	Injured by winter, 1906-7.
37	2.5	13.0	0.5	Injured by winter, 1906-7.
38	0.0	15.0	0.0	
39	7.0	19.0	2.0	
40	0.0	0.0	8.3	
Average	5.1	6.4	2.9	*Average per tree for 3 years, 4.8 bushels.*

Annual Yields, "Fisher" vs. "Station" Fertilizers,—Tolman.

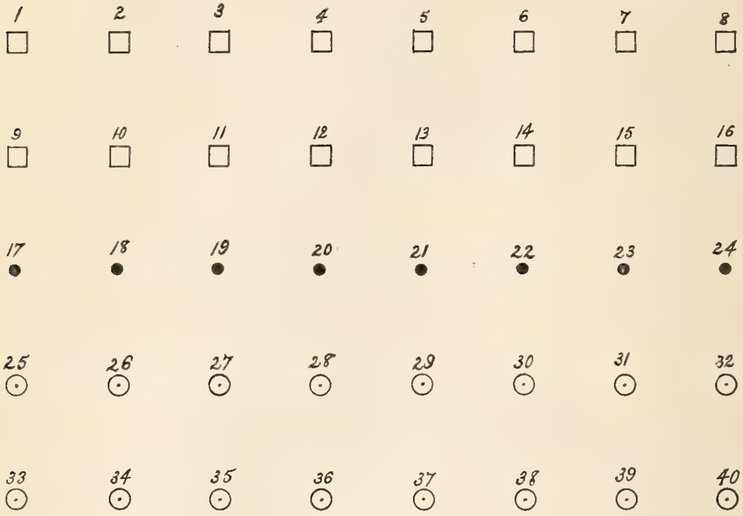
Treatment and number of tree.	Yield per tree, in bushels.			Remarks.
	1905.	1906.	1907.	
Fisher Formula				
No. 6	4.5	10.2	4.5	
11	1.1	8.3	7.3	
13	.5	2.1	2.0	
20	2.8	9.3	3.8	
Average	2.5	7.5	4.4	*Average per tree for 3 years, 4.8 bushels.*
Station Formula				
No. 4	...*	4.5	12.8	*Tag lost, 1905; Number 4 and 5 adjoined "hog-culture" orchard and were thus stimulated, 1906.
5	.8	9.0	14.5	
12	2.5	3.0	5.3	
19	1.8	6.3	3.0	
Average	1.7	5.7	8.9	*Average per tree for 3 years, 4.1 bushels.*

From field observations each year, from a study of annual individual yields, annual average yields, or the average total yields for 3 successive years, the writer is unable to point out definite results. While unquestionably the "Fisher formula" is useful in quickly starting a vigorous growth, in the case of neglected, sod-bound trees, it apparently is not, in a series of years, superior to a less expensive and better balanced formula.

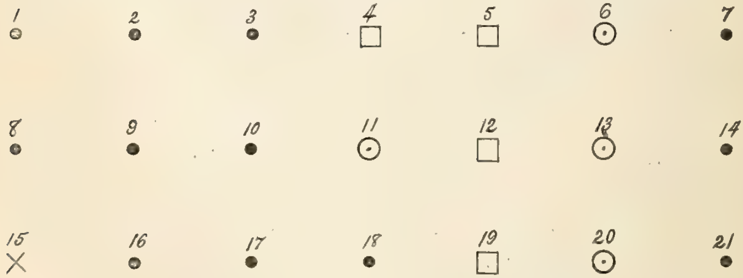
After a study of all the factors involved, the following tentative conclusions seem justified: (1) The percentage of nitrogen in the Fisher formula is too high for the best results with fruit. (2) On most soils the Fisher fertilizer is unnecessarily expensive, and is wasteful of available nitrogen. (3) The Fisher fertilizer results in the production of fruit which is large but of poor color and coarse texture. (4) The Station fertilizer, or some similar mixture containing about 3 per cent of nitrogen, 6 per cent phosphoric acid and 8 to 10 per cent of potash, with a supply of humus in the form of cover crops or as a mulch, is most satisfactory for general orchard use for a term of years.

The following diagrams represent the orchards under observation.*

Fisher Formula – Diagram of Baldwin Orchard.



Fisher Formula – Diagram of Tolman Orchard.



Explanation of Diagram. □ *– Station formula;* ⊙ *– Fisher formula;* ● *– untreated tree;* × *– vacancy.*

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*From Bulletin 122.

SPRAYING EXPERIMENTS.

The fact of the financial gain to be derived from rational spraying of orchards, is no longer in doubt. As a matter of insurance, therefore, every orchard should be sprayed in April, before the buds open, again just before the blossoms open, and at least once after the fruit sets. If any application is to be omitted, let it not be the first, as this application is specially valuable in checking fungous diseases whose spores have lived over winter. It is also the only possible time to fight the bud moth, which has become a serious menace to many orchards of the State.

The first application should consist of the standard Bordeaux mixture (5—5—50 formula) and arsenate of lead.* Should San Jose scale be suspected, the lime and sulphur mixture may be substituted for the first Bordeaux treatment. For later applications, weaker Bordeaux (3—5—50, or even 2—4—50) is safer, and apparently as effective.

For the purpose of investigating the question of "spray injuries," and certain points in field practice, a series of experiments, to extend over a period of 5 years, was inaugurated in the spring of 1907, in the orchard of Phineas Whittier, at Farmington Falls. A power sprayer of the best type was purchased, and practical orchard spraying, on a somewhat extensive scale, was carried on during the season.

From a practical point of view, this work was successful, and served its purpose of demonstrating to the orchardists in the vicinity the value of the work. McIntosh apples which, for several years, had been absolutely worthless because of scab, were this year clean and in good market condition; while on unsprayed trees near at hand, the fruit was worthless. Baldwins, likewise, showed unmistakable advantage from the spraying. More technical studies were prevented by the writer's absence from the State.

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* "How to Fight Apple Enemies," containing formulas for various spraying mixtures, will be sent to any address in the State upon application to the Experiment Station.

ORCHARD WORK AT NEW GLOUCESTER.

The work at New Gloucester is not sufficiently developed to warrant conclusions. As noted in a previous report,* the value of a cover crop, with the dangers attending its wrong use, have been fully demonstrated in the orchard of Mr. John W. True. Further work in this direction has been dropped. A duplication of the study of the comparative merits of certain fertilizers for apples, described on pages 139-141, has been conducted for 3 years, with the results given below.

The Fisher Formula at New Gloucester.

For the purpose of obtaining a fuller knowledge of the effects of highly nitrogenous manures, upon both tree and fruit, an orchard of Baldwins, set about 20 years, and sadly in need of pruning, was selected. The soil is a strong gravelly loam, well located, and altogether presenting the best possible conditions for the work. The trees were of a productive age, but not in a productive condition. Being but 20 feet apart, they were already beginning to crowd.

In 1905, the trees were pruned, the land was plowed, and thoroughly harrowed, and fertilizers were applied as follows: 4 rows were given stable manure; 4 rows Station fertilizer; 4 rows Fisher fertilizer; with a check row between each two plats, as shown in the diagram.

The stable manure was applied broadcast over the whole surface of the ground, at the rate of 1-10 cord per tree.

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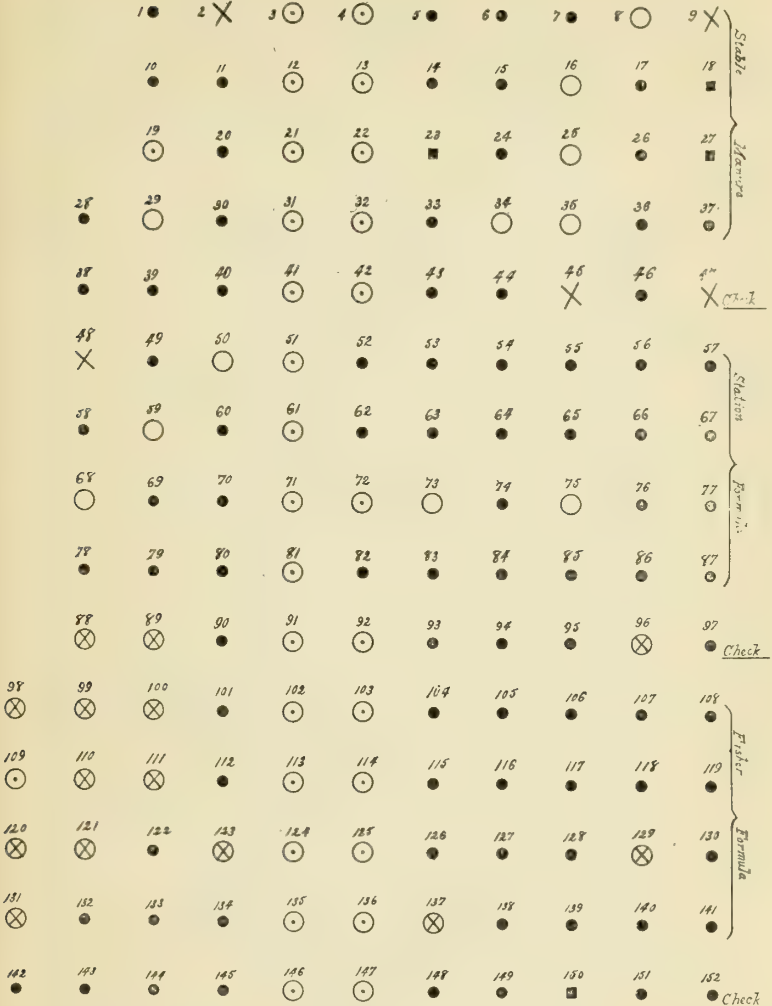
* Bulletin 122 of this Station, p. 203.

Fisher Formula at New Gloucester.— Diagram of Orchard.



		1 ●	2 X	3 ⊙	4 ⊙	5 ●	6 ●	7 ●	8 ○	9 X	Stable
		10 ●	11 ●	12 ⊙	13 ⊙	14 ●	15 ●	16 ○	17 ●	18 ■	
		19 ⊙	20 ●	21 ⊙	22 ⊙	23 ■	24 ●	25 ○	26 ●	27 ■	Manure
	28 ●	29 ○	30 ●	31 ⊙	32 ⊙	33 ●	34 ○	35 ○	36 ●	37 ●	
	38 ●	39 ●	40 ●	41 ⊙	42 ⊙	43 ●	44 ●	45 X	46 ●	47 X	Check
	48 X	49 ●	50 ○	51 ⊙	52 ●	53 ●	54 ●	55 ●	56 ●	57 ●	Station
	58 ●	59 ○	60 ●	61 ⊙	62 ●	63 ●	64 ●	65 ●	66 ●	67 ●	
	68 ○	69 ●	70 ●	71 ⊙	72 ⊙	73 ○	74 ●	75 ○	76 ●	77 ●	Form[illegible]
	78 ●	79 ●	80 ●	81 ⊙	82 ●	83 ●	84 ●	85 ●	86 ●	87 ●	
	88 ⊗	89 ⊗	90 ●	91 ⊙	92 ⊙	93 ●	94 ●	95 ●	96 ⊗	97 ●	Check
98 ⊗	99 ⊗	100 ⊗	101 ●	102 ⊙	103 ⊙	104 ●	105 ●	106 ●	107 ●	108 ●	Fisher
109 ⊙	110 ⊗	111 ⊗	112 ●	113 ⊙	114 ⊙	115 ●	116 ●	117 ●	118 ●	119 ●	
120 ⊗	121 ⊗	122 ●	123 ⊗	124 ⊙	125 ⊙	126 ●	127 ●	128 ●	129 ⊗	130 ●	Formula
131 ⊗	132 ●	133 ●	134 ●	135 ⊙	136 ⊙	137 ⊗	138 ●	139 ●	140 ●	141 ●	
142 ●	143 ●	144 ●	145 ●	146 ⊙	147 ⊙	148 ●	149 ●	150 ■	151 ●	152 ●	Check

Explanation of Diagram:— ● = *Baldwin*, ⊙ = *Ben Davis*,
○ = *Milding*, ⊗ = *Stark*, ■ = *Mixed varieties*, X = *Vacancy*.

(With the exception of the two rows it was supposed to be a solid block of Baldwins. The other varieties have been put in to fill vacancies).

The Fisher fertilizer was made up after the well known "Fisher formula," and applied broadcast at the rate of 10 pounds per tree. As actually used, for the 40 trees, this fertilizer was as follows: Nitrate of soda, 140 lbs., sulphate of ammonia, 60 lbs., sulphate of potash, 92 lbs., acid phosphate, 88 lbs., kainite, 20 lbs. (Kainite was substituted for keiserite of the Fisher formula).

The Station fertilizer was applied at the rate of 10 pounds per tree, in the same way, and as used was made up as follows: Nitrate of soda 80 lbs., sulphate of ammonia 30 lbs., acid phosphate 200 lbs., muriate of potash 90 lbs.

The trees responded at once. Although no fruit was produced in 1905, the trees made a vigorous growth, and the difference in color between the check rows and the others was most noticeable.

In 1906, and again in 1907, because of the exceedingly vigorous growth induced, and because of the fact that the trees are so close together, only one-half the amount of fertilizer was used. Otherwise the treatment was as in 1905; a few young hogs being allowed to run in the orchard the latter part of the season.

In 1907, the orchard was almost ideal in its general appearance and behavior; except that the trees are beginning to crowd too much. The color of the fruit from the "Station" plat was, as a rule, superior to that upon either of the other plats. There were, however, as might be expected, individual exceptions to this rule. In every instance the check rows were distinctly noticeable by their relative lack of color and vigor; although they would naturally get some benefit from the fertilizer applied to adjacent plats. Records of annual growth were not kept, but the yield of individual trees is given below. No comment is necessary, as the work is incomplete. The records will be continued, however.

In the table, the trees of each row are placed in groups. With reference to fertilizers, numbers 1—37 receive stable manure; 48—87, Station fertilizer; 98—141, Fisher fertilizer; 38—47, 88—97, and 142—152, no fertilizer. Trees marked with a star (*), are Milding or Wealthy, and the fruit ripens earlier, so that no record is kept.

Annual Yields, Fisher vs. Station Fertilizer, New Gloucester.

No. of tree.	Yield per tree, in bushels.		No. of tree.	Yield per tree, in bushels.		No. of tree.	Yield per tree, in bushels.		No. of tree.	Yield per tree, in bushels.	
	1906.	1907.		1906.	1907.		1906.	1907.		1906.	1907.
1	0	7.5	38	2.4	5.3	78	8.3	1.8	120	3.1	.0
2	....	....	39	1.5	....	79	.2	2.3	121	2.4	2.7
3	2.4	4.1	40	.0	3.8	80	1.8	5.3	122	.2	.5
4	6.3	.8	41	2.0	2.5	81	4.8	2.0	123	3.8	.....
5	.0	.8	42	.0	1.0	82	1.5	2.5	124	1.8	.0
6	4.0	1.0	43	.0	3.0	83	.5	2.8	125	1.5	.8
7	.0	5.3	44	.5	.3	84	1.7	5.5	126	3.3	1.8
8	*	*	45	....	....	85	6.7	5.3	127	3.5	3.0
9	....	....	46	1.0	4.3	86	3.0	6.3	128	3.0	4.4
			47	....	....	87	.0	.5	129	5.0	2.2
									130	2.8	7.9
10	.0	10.6	48	....	....	88	.0	4.5	131	5.3	1.2
11	2.8	3.7	49	.5	5.3	89	1.8	8.0	132	1.5	.3
12	3.0	.5	50	*	*	90	.0	4.5	133	2.8	7.3
13	.5	3.3	51	4.3	.8	91	2.4	1.5	134	2.0	3.5
14	.3	5.5	52	1.5	1.7	92	3.0	4.8	135	4.0	0.0
15	.0	1.5	53	.5	4.5	93	.0	3.2	136	1.8	.4
16	*	*	54	.0	.0	94	.0	.4	137	1.5	.0
17	2.0	3.5	55	1.3	3.0	95	.2	4.3	138	1.1	3.3
18	.8	1.0	56	.3	2.3	96	.3	2.0	139	2.5	4.0
			57	2.5	4.3	97	1.0	3.2	140	4.5	3.3
									141	.5	5.8
19	5.8	.5	58	2.9	4.5	98	3.3	....	142	2.8	2.0
20	.0	6.8	59	*	*	99	4.3	4.5	143	1.3	9.2
21	6.4	1.5	60	1.3	2.0	100	4.5	2.8	144	.0	2.0
22	.4	2.5	61	.5	4.7	101	4.8	4.5	145	1.0	5.3
23	....	.3	62	1.0	3.2	102	3.8	.3	146	1.0	.3
24	.3	5.4	63	.0	4.5	103	3.8	1.3	147	2.3	.7
25	*	*	64	.0	.3	104	3.8	4.0	148	1.0	6.3
26	.3	4.5	65	.3	6.0	105	.0	1.0	149	2.3	3.2
27	5.5	2.3	66	3.4	2.8	106	5.0	1.0	150	.0	.3
			67	2.4	1.5	107	1.6	4.0	151	2.0	4.0
						108	.0	....	152	.8	.8
28	5.3	.5	68	*	*	109	6.5	2.0			
29	1.0	....	69	5.9	8.5	110	4.9	.5			
30	.5	.8	70	.2	5.2	111	3.3	2.3			
31	1.4	2.0	71	.8	1.5	112	5.5	1.5			
32	.4	.7	72	.5	.9	113	5.0	.3			
33	.0	2.5	73	*	*	114	2.5	.8			
34	*	*	74	1.0	4.3	115	1.5	2.5			
35	*	*	75	*	*	116	4.5	1.5			
36	.3	5.0	76	1.3	.0	117	1.8	1.9			
37	.5	5.0	77	.0	.5	118	1.9	8.4			
						119	3.3	6.4			

THE APPLE ORCHARD AT ORONO.

In view of the behavior of many supposedly hardy varieties, under the stress of the hard winter of 1906-1907, and the fact that no similar collection is available for study in northern New England, the following notes on the behavior and present condition of the apples in the Station orchards at Orono are recorded. No account is given of the newer Russian varieties, for reasons stated in Bulletin 82,* viz., that among the varieties of this class none have been found which are superior to well known commercial sorts; and furthermore that almost without exception these varieties drop badly from the tree and are of relatively inferior quality. Their one merit is that of hardiness.

There are 3 distinct parts to the Station orchard, and in the following alphabetical list of the leading varieties these orchards are designated I, II, and III respectively; the individual tree numbers being given in numerals: e. g., "Akin, I, 63," indicates that the tree under consideration is number 63 in Orchard I. "Reference" indicates former publications of this Station in which this variety has been mentioned.

Many of the varieties were obtained in 1890 before the writer's connection with the Station, and were held in nursery rows until transferred to the orchard in 1891 or 1892. During the earlier years of its history, the orchard was used as a vegetable garden; for the last 8 years, clean cultivation has been given until about August 10, when a cover crop has been sown for winter protection.

No attention is given other fruits in the accompanying notes, but as indicating the severity of the "test-winter" of 1906-1907, when the lowest officially recorded temperature was 40 degrees below zero, it may be said that practically every pear tree at the Station, both dwarf and standard, was destroyed. The same is true of many cherries. The small fruits, however, being protected by the deep snow, wintered in good condition. The notes are given without comment, simply as a matter of record and for general information.

AIKIN, I, 63.—Stark Brothers, Louisiana, Mo., 1899. First fruit, 1902; full crop, 1906. Vigorous and in good condition, 1907.

ALEXANDER, I, 83; II, 9.—Ellwanger & Barry, Rochester, N. Y., 1890. *References:* Annual Report, 1898, pp. 69-72; Bulletin 82, pp. 83, 86.

Permanently set May, 1891. First fruit 1895; 1902, 3 bushels; 1905, 3 barrels. Prolific, profitable. Good condition, 1907.

ARCTIC, I, 84; II, 3.—Ellwanger & Barry, Rochester, N. Y., 1890. *Reference:* Annual Report, 1898, pp. 69, 70; Bulletin 82, p. 89.

Permanently set, May, 1892. First bloom 1896; first fruit 1898; good crop, 1901. Has borne freely nearly every year since 1901. Badly injured by winter of 1906-07, after a full crop in 1906.

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* Bulletin 82 of this Station, p. 85.

ASTRACHAN, I, 13-17.—Ellwanger & Barry, Rochester, N. Y., 1891. *Reference:* Annual Report, 1898, p. 69.

Three-year trees, permanently set May, 1891; first bloom 1895; first crop fruit, 1896. All trees of this variety have borne freely since 1896. Good condition, 1907.

BOIKEN, I, 46; III, 27 and 47.—S. D. Willard, Geneva, N. Y., 1901. *Reference:* Bulletin 82, p. 89.

Top worked on Russian varieties (13 M., and Hibernal). Hardy, productive. In good condition, 1907. Not of high quality, but a promising sort.

CHENANGO, II, 6.—Ellwanger & Barry, Rochester, N. Y., 1889. *Reference:* Annual Report, 1896, p. 69.

Nursery row 2 years; permanently set May, 1891. First fruit 1896 (few, poorly colored); full crop 1898. Always bore well, but tree never thrived. Nearly killed by winter of 1906-07.

CRIMSON BEAUTY, I, 64; III, 54.—George L. McCabe, North Bangor, Me., 1904.

Top worked on a Russian sort, No. 50 Voronesch, (III, 54), the variety has made a vigorous growth. Fruited in 1907. A promising early, hardy sort; largely grown in Aroostook county and in New Brunswick. Of good quality and high color; early as Yellow Transparent.

DARTMOUTH, I, 9, 10.—Ellwanger & Barry, 1891.

Three-year tree, set 1891. First fruited 1898, and has borne nearly every year since. Hardy, vigorous, productive. Good condition, 1907.

DOCTOR, III, 6; I, 28.—U. S. Department of Agriculture, 1896. *Reference:* Bulletin 82, p. 89.

Top-worked into Alexander and into Haas. A vigorous grower and heavy annual bearer. Killed by winter of 1906-07.

FALLAWATER, I, 57. Ellwanger & Barry, 1893. *Reference:* Annual Report 1896, p. 69.

Set May, 1893. First fruit, 1902. Not a vigorous tree, (growing in sod, because of encroachment of lawn, since 1895); bore full crop fruit 1906. Killed by winter, 1906-07.

FAMEUSE, I, 18-22, II, 2.—Ellwanger & Barry, 1889. *Reference:* Annual Report 1896, p. 69.

Permanently set May, 1891. First fruit, small crop, 1898. Hardy, vigorous, productive. Subject to attack of apple scab. Good condition, 1907.

FLORENCE, II, 14. Peter M. Gideon, Excelsior, Minn., 1889.

Permanently set, May, 1891. The tree is very productive and as a result is small and deformed; having been broken by weight of fruit. One of Gideon's seedlings. A handsome early crab.

GIDEON, II, 8.—Peter M. Gideon, 1890. *Reference:* Bulletin 82, p. 83.

Tree killed by mice 1892. Replaced 1896. Tree vigorous, hardy, productive. Fruit beautiful in appearance, but drops badly and is of no special value. Good condition, 1907.

GOLDEN RUSSET (of Western New York) I, 76; III, 61.—Ellwanger & Barry, 1890.

Permanently set May, 1891. First bloom 1896; first fruit, 1897. Hardy, vigorous, productive. Good condition, 1907.

HAAS, I, 26-30.—Ellwanger & Barry, 1890. *Reference:* Annual Report 1896, pp. 69, 70.

Permanently set, May, 1891. First bloom 1894; first fruit 1896. Bore freely every year after 1896 until top-grafted to other sorts, 1901, and 1902. Hardy, vigorous, and very productive. The fruit does not keep well, however.

HURLBUT, II, 10.—Ellwanger & Barry, 1889. *References:* Annual Report, 1898, p. 69; Bulletin 82, p. 89.

Permanently set, May, 1891. First fruit 1898. Prolific, annual bearer. Nearly killed by winter of 1906-07.

HYSLOP (crab), I, 3, 4.—Ellwanger & Barry, 1891.

Three-year old trees, set permanently May, 1891. Small amount of fruit 1893; full crop 1896, and nearly every year since. Good condition, 1907.

JONATHAN, I, 27.—George T. Powell, Ghent, N. Y., 1902.

Top-grafted on bearing trees of Haas. Made strong growth every year. Killed by winter of 1906-07.

MANN, I, 82. Ellwanger & Barry, 1890. *Reference:* Annual Report, 1896, p. 69.

Transferred from orchard III, to fill vacancy, in 1895. Vigorous grower and very productive, but fruit of poor quality. Tree died, 1903-04, after a full crop.

MARENGO (crab), I, 5.—Ellwanger & Barry, 1891.

Three-year tree, set May, 1891. Bore a few fruits, 1896, but no full crop till 1900. Hardy, vigorous; good condition, 1907.

MCCLELLAN, I, 29.—J. J. Towle, South Carthage, Maine, 1902.

Top-graft inserted in Haas, 11 years old, April, 1902. Vigorous, healthy, promising. Good condition, 1907.

MILDING, I, 43-47.—R. G. Chase & Co., Geneva, N. Y., 1891. *References:* Annual Report, 1896, pp. 69, 71; Bulletin 82, p. 89.

Permanently set, May, 1891. First fruited 1899; full bearing 1903. Somewhat injured, 1906-07, after a full crop.

MONTREAL BEAUTY, I, 7, 8.—Ellwanger & Barry, 1891.

Three-year tree set permanently, May, 1891. First fruit, small crop, 1896. Vigorous, hardy. Good condition, 1907.

MUNSON SWEET, III, 62.—Ellwanger & Barry 1890. *Reference:* Bulletin 82, p. 89.

First fruited 1895. Vigorous, hardy, a free bearer of excellent fruit. Died from canker at base of tree, 1904.

NORTHERN SPY, III, 65; I, 78.—J. E. Bennoch, Orono, Maine, 1906.

Number 65, top-grafted into bearing tree of the Russian variety Arabka; Number 78 grafted on young seedling stock. All cions made a vigorous growth in 1906, and every one was killed by the winter following.

Northwestern Greening, I, 86. Storrs & Harrison Co., Painesville, Ohio, 1895. *Reference:* Bulletin 82, p. 90.

Set May 1895; first fruit 1902. Vigorous, hardy, productive. Not of high quality. Specially promising as a stock for top-grafting. Good condition, 1907.

Oldenburg, I, 35-39.—Ellwanger & Barry, 1890. *References:* Annual Report 1896, p. 69; Bulletin 82, p. 84.

Permanently set, May, 1891. Full crop on all trees 1896, and nearly every year since. Numbers 35, 36 and 37 are on a poor sandy knoll, and have never thrived. The other trees have been exceptionally productive.

Paradise Sweet, I, 30.—Chas. S. Pope, Manchester, Me., 1902.

Top-grafted into Haas, 11 years old, April, 1902. Has made strong growth every year. Somewhat injured by cold, 1906-07.

Pewaukee, I, 75; II, 4.—Ellwanger & Barry, 1890. *Reference:* Annual Report, 1896, pp. 69, 71.

Permanently set, May, 1891. First fruit 1894 (few specimens). No. 4 bore 1½ bushels in 1896, and has given a fair crop nearly every year since. Vigorous, hardy. Is being grown in some parts of Maine as a stock for top-grafting to Baldwin.

Porter, I, 31-34 and 72, 73.—Ellwanger & Barry, 1891. *Reference:* Annual Report, 1896, p. 69.

Permanently set, May, 1891. Nos. 31 to 34 were top-grafted in the nursery, while 72 and 73 were nursery budded trees. The top-worked trees fruited freely after 1899; the others were disturbed by removal of soil in 1893 and never fully recovered, though fruiting freely after 1901. All trees of this variety were fatally injured by cold of 1906-07.

Primate, III, 67.—Ellwanger & Barry, 1894.

First fruits in 1900. Badly attacked by canker, and half of tree cut away, 1905; in weakened condition, killed by winter of 1906-07. Apparently one of the best early varieties for home use.

Princess Louise, I, 53. Ellwanger & Barry, 1891. *Reference:* Annual Report, 1896, p. 69.

First fruit, 1896; usually a few fruits every year thereafter. The tree was on poor, sandy soil, and was always "black hearted" and feeble. Killed by winter of 1906-07.

Rall (Rall's Janet), I, 85.—Ellwanger & Barry, 1890.

Grown in nursery row till 1892. Fruited freely since 1900. Attacked by woolly aphis, 1905. Killed by winter of 1906-07, after a full crop of fruit in 1906.

Red Fameuse, III, 55; I, 80.—B. M. Titcomb, Farmington, Me., 1903.

Cions top-grafted into (No. 55) a bearing tree of the Russian variety, Large Anis. No. 80 is crown grafted on seedling stock. First fruit 1906. A very highly colored type of Fameuse, grown freely in Franklin county. Source unknown; hardy, vigorous.

ROLFE, III, 34.—H. L. Leland, Sangerville, Me., 1902. *References:* Annual Report 1896, pp. 69, 71, 81; Bulletin 82, p. 90; Bulletin 143, pp. 114, 130.

Very strong grower and gave good crop of fine fruit in 1906; but was nearly destroyed by the winter following. This destruction must have been due to immaturity of season's growth, as the variety is largely grown at much more northerly points.

SHIAWASSEE, II, 5.—Ellwanger & Barry, 1889. *References:* Annual Report, 1896, pp. 69, 72; Bulletin 82, pp. 84, 90.

Permanently set, May, 1891. First fruit 1896; full crop 1897. Vigorous, productive, hardy.

STARK, I, 58-62.—R. G. Chase & Co., Geneva, N. Y., 1891. *Reference:* Annual Report, 1896, p. 69.

First bloom 1896; first fruit 1898. Owing to encroachments of buildings and lawn, these trees have not been cultivated since 1895. Hardy, productive.

SUTTON, III, 17, 38.—S. D. Willard, Geneva, N. Y., 1898.

Top-grafted into Russian varieties, these cions grew very vigorously and produced fruit freely in 1904, 1905 and 1906. No. 17 began to fail in 1905, died 1906-07. No. 38 was badly injured by cold of 1906-07. Top-grafts in Porter (Orchard I, No. 31, cions from George T. Powell, Ghent, N. Y.) grew vigorously but were badly checked by the winter of 1906-07. A young tree from the Station nursery, set (I, 87) in 1904, was also killed by the winter of 1906-07.

THOMPSON SEEDLINGS.—Jewell Nursery Co., Lake City, Minn., 1892. *Reference:* Annual Report 1896 p. 69.

Thompson seedlings Nos. 24, 26, 29, 42, and 43, under trial by request, proved to be hardy, vigorous and productive, but only of moderately good quality, and of no special value for New England. They would be classed with the Russian and other "iron-clad" varieties.

TRANSCENDENT (crab) I, 1, 2.—Ellwanger & Barry, 1891.

Three-year trees, set 1891. Full crop 1894, and almost every year since. Like the other crabs, is perfectly hardy and vigorous.

VAN WYCK (crab), I, 6.—Ellwanger & Barry, 1894.

Three-year trees, set 1891. Full crop 1894, and almost every year year since. Hardy, productive.

WALBRIDGE, I, 79.—Stark Brothers, Louisiana, Mo., 1889. *Reference:* Annual Report, 1896, p. 69.

Grown in nursery row until 1892. First fruit 1896. Tree broken by weight of fruit, in 1903, and removed. Very vigorous and productive, but of poor quality.

WEALTHY, I, 11, 12, 23-25, III, 68.—Ellwanger & Barry, 1890. *References:* Annual Report, 1896, p. 69, 77; Bulletin 82, p. 85, 90.

Permanently set, May, 1891. First full crop, 1896. Hardy, vigorous, and very productive. Trees liable to overbear and break under weight of fruit.

WESTFIELD, I, 69. Ellwanger & Barry, 1891. *References:* Annual Report, 1896, p. 69; Bulletin 82, p. 90.

Tree lowered on account of grading, 1904. Soil not suitable, and tree was never vigorous, but fruited for several years. Full crop, 1906. Tree in weakened condition killed by winter of 1906-07.

WINESAP, I, 48-52.—Ellwanger & Barry, 1891. *Reference:* Annual Report, 1896, p. 69.

The trees were vigorous and productive; first fruits (few specimens) 1895. Every tree killed by winter of 1906-07. The fruit is very disappointing in New England. The typical Winesap flavor is not developed, and its quality is not much better than that of Ben Davis.

WOLF RIVER, I, 74.—Storrs & Harrison Co., Painesville, Ohio, 1895. *Reference:* Annual Report, 1896, p. 69.

First fruited 1902; full crop 1904, also 1906. Tree hardy, vigorous, productive. Stood the winter of 1906-07 well, and blossomed full in 1907.

THE MAINE STATION AND POMOLOGY.

Chas. D. Woods.

Since the establishment of the department of horticulture in the Maine Agricultural Experiment Station, in 1891, the subject of orcharding has received considerable attention. As is well known, the Station is located too far north to successfully grow the apples for which Maine is most noted, and the soil at the University of Maine is illy adapted to orcharding. Aside from a study of hardy fruits for northern Maine, it was not until co-operative experiments were begun with Mr. Chas. S. Pope at Manchester, about ten years ago, that very definite advance was made in studies of orcharding by the Maine Station. Mr. Pope very kindly placed his orchards at the disposal of the Station, and what has been accomplished during the past ten years has been largely due to this liberality on the part of Mr. Pope. These investigations in orcharding were planned and conducted by Professor W. M. Munson, and have been reported in the bulletins of this Station from time to time. The present bulletin summarizes and brings up to date the results obtained. As is known to most of the pomologists of the State, Professor Munson resigned his position with this Station in July, 1907, and is now connected with the West Virginia Experiment Station.

It has sometimes been urged at the meetings of the State Pomological Society, and elsewhere, that the Maine Agricultural Experiment Station should devote more of its energies to the fruit interests of Maine; that these interests are important; and that there are many questions which are pressing for solution. The management of the Station appreciates the value of the pomological interests of the State, and the need of investigations, both scientific and practical. It may be fitting to outline here the reasons why it is not hoped, in the immediate future, to undertake further fruit studies; although it is recognized by the management that such studies are eminently desirable.

It is possible, as illustrated by the studies which the Station has made upon the potato, to carry on successfully in co-operation with farmers, studies upon an annual crop. It is not practicable however, to carry on fundamental investigations upon a crop requiring many years for its growth, upon land and in orchards which are not under absolute control, for a long period of years. Valuable as the results are that have been obtained through the co-operation of Mr. Pope, obviously experiments extending over long series of years could not be undertaken. Recognizing this, the fruit interests of the State asked the legislature of 1907 to consider the question of purchasing for the use of the Station a farm that should be located in the apple growing section of the State and provided with orchards and equipment suitable for pomological investigations. The organized agricultural interests of the State, including the State Pomological Society, the State Dairyman's Association and the State Grange, passed resolutions asking that such opportunity for orchard investigations be provided. At the legislative hearing many appeared in favor of the bill, and no one in opposition, and so far as known the matter was not opposed by any member of the legislature. For some reason not clearly evident, the legislature, on the recommendation of the committee on agriculture, voted to refer the matter of the purchase of a farm to the legislature of 1909.

Early in the winter of 1907, Professor Munson received a flattering invitation to leave the Maine Station and take up work elsewhere. At that time it was confidently expected that the legislature would provide a farm and opportunities for pomological research. With that thought in mind, this offered position was declined and Professor Munson decided to remain with the Maine Agricultural Experiment Station, as he believed there to be a valuable field for investigation and he confidently hoped that facilities would be provided. After the adjournment of the legislature, an offer came to him from West Virginia which he accepted, largely because the opportunities which were there offered along pomological lines were so much greater than the Maine Station had or was likely to have in the near future.

The question has frequently been asked,—"Who will take Professor Munson's place at the Experiment Station?" It does not seem to be practicable at present to invite anyone to come to the Station to take up this line of work as Professor Munson's successor. The same reason that led to his resignation would prevent the right kind of a man coming to the Maine Station in pomological lines. Until orchards and suitable buildings for the study of pomological problems are provided for the Station, in the apple section of the State, it will be impossible to offer facilities for work that would be attractive to a man who wants not merely a salary, but opportunities for work and investigation. Obviously the kind of a man that would come for the sake of the salary, is not the man wanted. The Station will continue to study orchard insects and the fungous and other diseases of the orchard as it has in the past, but the direct pomological questions, many of which are pressing and urgent, cannot be taken up until such time as suitable facilities are available. The Station has funds enough which can be used for the purpose of these studies, but has no funds which can be used for the purchase or rental of lands or orchards or buildings needed for the successful carrying out of investigations fundamental to orcharding.

At the annual meeting (November, 1907) of the State Pomological Society, great interest was shown in the work which the Station has been able to accomplish, and strong expressions on the part of the officers and others prominent in the management of the Society were made relative to the desirability of suitable facilities being provided the Station for making these needed studies. This matter of providing orchards and facilities in the apple section of the State will come before the next legislature, and it is hoped that it may meet with favorable action. Until then, the Station will continue to show its interest in the orcharding of Maine by doing what it can along the lines of entomological and pathological studies. It cannot hope to take up the direct problems of pomology at once, nor can it, under present conditions, hope to invite to this Station an earnest student of pomology.

BULLETIN 150 TO 153.

Bulletin 150 contains the financial report for 1906-7, the meteorological observations for 1907, and the index of the bulletins published in 1907. It was sent to the official mailing list and to libraries.

Bulletin 151 on Food and Drug Inspection contains analyses of molasses, vinegar, honey, cream of tartar, etc., and was sent to the official mailing list, to libraries, and to dealers in Maine.

Bulletin 152 on Seed Inspection contains the report of the analysis of seeds examined in 1907. Bulletin 153, Fertilizer Inspection contains the analyses of manufacturers samples of fertilizers licensed for 1908. These bulletins (152 and 153) were sent to the official mailing list, to libraries and to the general mailing list of the Station.

These bulletins will be sent on application to any address until the editions are exhausted. Requests for bulletins should be addressed to the

Maine Agricultural Experiment Station,
Orono, Maine.